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## ENVIRONMENTAL STRESS SCREENING HANDBOOK

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# FORWARD

This handbook describes the Sacramento Air Logistics Center's (SM-ALC) Environmental Stress Screening (ESS) Program. It is intended for use by engineers, equipment specialists, project managers and others who are required to implement the ESS program in either the repair process (organic or contractual) or the acquisition process. This document supersedes all other ESS guidance documents prepared by SM-ALC and/or distributed to SM-ALC personnel.

This handbook is not to be used as a reference document in a specification or statement of work nor is it to be used in a "cookbook" fashion. It is to be used in combination with knowledge of the equipment and the manufacturing process to develop a viable ESS program.

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## 1. SCOPE

1.1 Purpose. This document defines the Reliability and Maintainability (R&M) 2000 Environmental Stress Screening (ESS) requirements for electronic and electromechanical equipment. This document provides for a uniform ESS program which will be used to disclose manufacturing and part defects in electronic equipment. Design deficiencies may also be disclosed although this is not the primary purpose of ESS. This document is intended to be used as a guideline for incorporating ESS in all purchase requests. In addition, this document is applicable to existing hardware that is to be repaired (either contract repair or organic repair).

1.2 Application to Products. The guidelines described herein shall be applied to electronic and electromechanical items at the Line Replaceable Unit (LRU) level, Line Replaceable Module (LRM) level and the Shop Replaceable Unit (SRU) level. This includes replacement items as well as replenishment spare parts. The stress threshold may vary depending on whether the item being screened is an LRU, LRM or SRU, but the intent is to screen both levels of assembly.

## 2. REFERENCED DOCUMENTS

2.1 The documents cited in this section are for guidance and reference.

DCD-HDBK-344	Environmental Stress Screening of Electronic Equipment
MIL-HDBK-245B	Preparation of Statement of Work (SOW)
MIL-STD-490A	Specification Practices
MIL-STD-721	Definition of Terms for Reliability and Maintainability
MIL-STD-781D	Reliability Testing for Engineering Development, Qualification and Production
MIL-HDBK-781	Reliability Test Methods, Plans and Environments for Engineering Development, Qualification, and Production
MIL-STD-785B	Reliability Program for Systems and Equipment, Development and Production, Notice 1

HQ AFLC/MM

New AFLC ESS Policy, 4 Nov 87

HQ USAF/CV

R&M Policy Letter #1, R&M 2000 ESS,  
6 Jan 86, revised 20 Jan 87.

2.2 Order of Precedence. During the preparation of ESS provisions, if there is a conflict between the text of this document and the references cited herein, the text of this document shall take precedence.

### 3. GENERAL ESS INFORMATION

#### 3.1 Introduction.

3.1.1 ESS is a production process to eliminate latent defects due to weak parts, uncontrolled manufacturing processes, and poor workmanship in electronic or electromechanical equipment. The goal of ESS is to improve the state of readiness of the using command by reducing the number of failures caused by production and/or repair problems. ESS is a closed-loop system of problem precipitation, identification, analysis, and correction. These guidelines are intended to help personnel develop, implement, and monitor an effective ESS program for their commodity.

3.1.2 The reliability is frequently degraded during production due to uncontrolled manufacturing processes, defective parts, and workmanship errors which the customer sees as infant mortality; the premature failure of a good design.

3.1.3 ESS also applies to organic repair of electronic or electromechanical equipment where the same type of latent defects can exist.

#### 3.2 Definitions

Terms used in this document are in accordance with the definitions in MIL-STD-721, MIL-STD-785B, MIL-STD-781D and DOD-HDBK-344, with the addition of the terms specified in paragraph 3.2.1 through 3.2.4.

3.2.1 Closed-Loop. A closed-loop process is a process whereby failures are precipitated with subsequent failure analysis to determine the cause of failure. Appropriate corrective action is then taken to correct the cause of failure. This process is continued until the majority of the infant mortality failures are eliminated.

3.2.2 Line Replaceable Module (LRM). An item which is a separable digital or analog electronic element of a standard size



and physical interface and which is functionally self-contained, to include its own testability and fault indication system. An LPM is usually replaced at the organizational level to restore operation of the system or equipment.

3.2.3 Line Replaceable Unit (LRU). Any assembly or part that can be replaced at the organizational level (on-equipment, direct support) to restore operation of the system or equipment. Usually in reference to a reparable (exchangeable) module.

3.2.4 Shop Replaceable Unit (SRU). An assembly or a combination of parts, subassemblies, and assemblies mounted together, normally capable of independent operation in a variety of situations and repairable at an air logistics center (or other repair depot).

### 3.3 Characteristics of ESS

3.3.1 Latent defects are stimulated by the responses of the system to environmental stresses. In order for ESS to be effective, the environmental response characteristics of the item must be understood. Effective ESS parameters should be developed in conjunction with the design phase for optimum screening results.

3.3.2 ESS is not a test. There is no pass/fail criteria for ESS. Failures, caused by latent defects, if they exist, are actually desired during ESS so that they can be corrected prior to the item being fielded. ESS weeds out defects on production and/or repair lines without significantly reducing the life of the equipment. ESS should be applied to 100 percent of the units manufactured or repaired; not just samples of these units. This provision shall be included in either the specification or the statement of work, depending on the specifics of the program.

3.3.3 The purpose of ESS is to accelerate environmental stresses in order to precipitate the maximum number of screenable defects in the shortest time. The purpose is to identify weak units but not to destroy good units, or introduce new defects. The equipment should be stressed beyond its normal operating mission environments, but not beyond its design limits.

3.3.4 ESS shall be accomplished at both the LRU/LRM and SRU level of assembly.

3.3.5 A combination of screens should be selected because different screens are effective for different kinds of expected defects. Recommended requirements include both rapid thermal cycling and random vibration for LRUs/LRMs. For SRUs, only rapid thermal cycling is required if the SRU will be installed in the

LRU/LRM and vibrated before leaving the production/repair facility (refer to paragraph 4.3.3g of this handbook). However, SRUs purchased as spares should undergo the same vibration as the associated LRU/LRM.

3.3.6 ESS shall be a dynamic process. A principle use of ESS is to create a process control mechanism in which the causes of ESS induced failures are investigated and eliminated or controlled. When control is established and the number of defects per unit drops to a minimum economical threshold, ESS should be modified or reduced to a sampling process.

#### 4. GENERAL ESS GUIDELINES.

4.1 General Requirements. ESS shall be accomplished on all deliverable equipment at the LRU, LRM or SRU level to ensure that hardware is free of manufacturing and part deficiencies. The contractor or repair activity shall be responsible for accomplishing ESS, but the Air Force may provide specific ESS requirements as enumerated in section 4.3. The following requirements shall be addressed by the contractor or repair activity:

4.1.1 For LRUs/LRMs, random vibration should be applied first followed by at least five thermal cycles since many common workmanship errors are precipitated quickly by vibration. Random vibration, when required, can be accomplished at any temperature during simultaneous vibration and temperature cycling. Vibration has a tendency to shake things loose that are then caught by temperature cycling.

4.1.2 Screening of fragile items. There may be elements of the assembly which cannot stand ESS stresses intended for production screens. In these cases, consider screening the more fragile item off-line at reduced stress levels and then inserting it into the previously screened assembly.

4.1.3 Screening of commercial off-the-shelf equipment. All commercial off-the-shelf equipment shall be stress screened unless it is unmodified and used in a benign environment.

4.1.4 It is desirable to have random vibration applied to the three principle axes of the equipment. The input vibration spectrum may be random or a simulated random (pseudo or quasi) vibration applied to a minimum of two axes. The R&M 2000 ESS guidelines show a square-shaped spectrum between 50 and 1000 Hz. The frequency ranges selected should, as a minimum, be a continuous spectrum between 50 and 1000 Hz.

4.1.5 The thermal response of the item being screened must

be determined. The environmental stresses may not be seen at the part level due to internal cooling or heating. Thermal surveys (in which the thermal response of the item is characterized) are essential to understand the responses of the individual components of the item and the chamber parameters should be assigned to achieve the desired response at the part level.

4.1.6 Too much screening (intensity, duration, and frequency) is neither effective nor efficient and may be harmful. Experience has shown that properly designed screens precipitate latent defects very quickly.

4.1.7 Failure free (FF) tests are not appropriate for ESS. If an item fails and is repaired, it need only be screened for what remains of its original screening program, providing a minimum of 25 percent of the original screen remains. If 25 percent of the original screen does not remain, the appropriate number of cycles must be added to the screening program such that FF cycles constitute a minimum of 25 percent of the screening program.

4.1.8 A closed-loop Failure Reporting Analysis and Corrective Action System (FRACAS) is a mandatory part of the ESS program. One method of doing this is by using MIL-STD-785B, Task 104 as a guide.

4.1.9 A tailored ESS program shall be designed and implemented. ESS implementation should occur at all levels of hardware assembly consistent with flaws and/or defects expected to be present and detectable at the respective levels of assembly. Production screens shall be continually analyzed for technical and cost-effectiveness with the results of this analysis being used to modify, eliminate and/or add screens as required.

4.1.10 For newly manufactured printed circuit boards which are to be conformal coated, ESS must be accomplished prior to conformal coating. If rescreening repaired assets, do not remove the conformal coating prior to screening.

4.2 ESS Conditions. The following conditions shall apply to all ESS processes.

4.2.1 ESS shall be accomplished in accordance with the Air Force guidelines as specified in paragraphs 4.3.1 through 4.3.3. ESS must stress the equipment beyond its operational requirements, to levels near but not beyond its design limits. It must be remembered that the basic purpose of the ESS program is to detect the largest number of component defects as well as manufacturing defects. Unless these defects are found during ESS they will

cause early and excessive failures in the field, with the resulting increase in life cycle cost.

4.2.2 All equipment at the LRU/LRM level, if possible, should be operating, installed in its normal orientation with protective covers or cases removed.

4.2.3 Simultaneous vibration and temperature stress screening is desired but not required. When temperature and vibration are applied separately, it is required that vibration occur prior to the temperature cycle. For a chamber that has combined temperature and vibration capability, at least five thermal cycles must follow vibration.

4.2.4 Triaxial random vibration is recommended at the LRU/LRM level. If triaxial vibration equipment is not available, the equipment must be rotated and vibrated for an equal amount of time in each axis.

4.2.5 The equipment's performance shall be verified both before and after ESS.

4.2.6 After a failure has occurred and the failure has been isolated and corrected, the equipment shall be operated and its performance monitored to ensure proper diagnosis and correction.

4.2.7 The Built-In-Test (BIT) capabilities shall be utilized to the maximum extent to aid in the performance monitoring. BIT shall not, however, be the sole means of monitoring performance.

4.3 R&M 2000 ESS Guidelines (R&M Policy Letter #1, R&M 2000 ESS, 6 Jan 86). Unless otherwise indicated in the equipment specification, the ESS regimen shall adhere to the Air Force ESS guidelines as specified in paragraphs 4.3.1 through 4.3.3. In most cases, the equipment should be screened, using the harshest possible environment, without causing undue damage to the equipment.

4.3.1 Thermal Requirements (See Note 9)

a. Temperature Range (See Note 10)

- |                   |                       |
|-------------------|-----------------------|
| 1. SRU Level:     | From -54 to +85 Deg C |
| 2. LRU/LRM Level: | From -54 to +71 Deg C |

- b. Temperature Rate of Change (See Note 1)
    - 1. SRU Level: 30 Deg C/Min
    - 2. LRU/LRM Level: 5 Deg C/Min
  - c. Temperature Dwell Duration (See Note 2)
    - 1. SRU Level: Until Stabilization
    - 2. LRU/LRM Level: Until Stabilization
  - d. Temperature Cycles (See Note 3)
    - 1. SRU Level: 25 Cycles
    - 2. LRU/LRM Level: 10 Cycles
  - e. Power On/Equipment Operating
    - 1. SRU Level: No
    - 2. LRU/LRM Level: See Note 4
  - f. Equipment Monitoring
    - 1. SRU Level: No
    - 2. LRU/LRM Level: See Note 5
  - g. Electrical Testing After Screen
    - 1. SRU Level: Yes (at ambient temp)
    - 2. LRU/LRM Level: Yes (at ambient temp)
- 4.3.2 Random Vibration Requirements (See Note 6)
- a. Power Spectral Density (See Note 7)
    - 1. SRU Level: 6 GRMS (50HZ to 1000 HZ)
    - 2. LRU/LRM Level: 6 GRMS (50HZ to 1000 HZ)
  - b. Axes stimulated serially or in combination
    - 1. SRU Level: 2 (Minimum) (See Note 8)
    - 2. LRU/LRM Level: 3

c. Duration of Vibration

1. SRU Level: 10 min/axis
2. LRU/LRM Level: 10 min/axis

d. Power On/Equipment Operating

1. SRU Level: No
2. LRU/LRM Level: See Note 4

e. Equipment Monitoring

1. SRU Level: No
2. LRU/LRM Level: See Note 5

4.3.3 Notes

a. Note 1: Use of chambers which will provide the temperature rate of change is desired. However, rapid transfers of the equipment between a chamber at maximum temperature and another chamber at minimum temperature is acceptable to accomplish the required temperature rate of change.

b. Note 2: The temperature has stabilized when the temperature of the part of the equipment having the longest thermal lag has met or exceeded the maximum or minimum temperatures for 5minutes.

c. Note 3: A minimum of five thermal cycles must be completed after the random vibration screen if thermal cycling and random vibration are not run concurrently.

d. Note 4: Operation shall occur during the low to high temperature excursion of the chamber and during vibration. Equipment shall be operating at maximum power loading. Power will be OFF on the high to low temperature excursion until stabilized at the low temperature. Power will be turned ON and OFF a minimum of three times at temperature extremes on each cycle.

e. Note 5: Instantaneous go/no-go performance monitoring during the stress screen is essential to identify intermittent failures. If such monitoring cannot be performed for one level of assembly, ESS will be performed on the next higher level of assembly, but using ESS specifications of the lower assembly, if they are more severe and do not exceed the design limits of the next higher assembly.

f. Note 6: Simultaneous random vibration and temperature stress screening is desired but not required. When temperature and vibration are applied separately, it is required that vibration occur prior to the temperature cycle. For a chamber that has combined temperature and vibration capability, at least five thermal cycles must follow vibration. Required vibration levels are a response function and will be measured by accelerometers placed on the items being screened.

g. Note 7: When quasi-random vibration is applied at the LRU/LRM level, random vibration is not required at the SRU level. However, subassemblies purchased as spares are required to undergo the same vibration required for the LRU/LRM level. An "LRU mock-up" or equivalent approach is acceptable. Vibration levels are the vibration levels that the unit being screened must experience. Vibration is usually measured by placing accelerometers on the unit(s) being screened.

h. Note 8: For an SRU, such as a printed circuit card, if only two axes are stimulated, one axis stimulated should be normal to the plane of the card, to assure that we are not just screening two basically symmetric axes and missing a critical orientation.

i. Note 9: The temperature parameters (i.e., temperature range and temperature rate of change) must be determined by placing thermocouples on the unit being screened. In all cases, these parameters are those that the unit being screened experiences and are independent of the chamber air temperature.

j. Note 10: The temperature ranges shall conform to the following criteria:

(1) The high temperature limit shall be no higher than the lowest high temperature limit of the individual components.

(2) The low temperature limit shall be no lower than the highest low temperature limit of the individual components.

4.4 Environmental Facilities. ESS facilities and apparatus used in conducting ESS programs contained in this plan shall be capable of meeting the conditions specified.

4.4.1 ESS Chamber. The ESS chamber shall conform to the following requirements:

a. The Unit Under Test (UUT) shall be placed in the ESS chamber so that there will be air flow around the unit. The

design of the fixture and the mounting of the UUT shall not inhibit the free-flow of air.

b. The heat source of the facility shall be so located that the radiant heat from the source will not fall directly on the UUT.

c. Any vibration generating machinery capable of satisfying the random vibration requirements specified herein is acceptable.

4.5 Performance Monitoring Requirements. The overall effectiveness of ESS is dependent upon the completeness of the performance monitoring before, during and after the environmental exposures. Prior to the environmental exposure, all functional parameters shall be verified and quantified. During ESS there must be an accurate assessment of equipment performance in terms of both permanent and intermittent failures.

4.6 Electronic Parts Reliability. ESS is a process which applies to parts, SRUs, LRUs, and LRMs. High quality, low defect rate parts reduce rework costs and increase the reliability of fielded systems. The Air Force requirement is to use parts (i.e., microcircuits, transistors, diodes, etc.) with a defect rate below 100 parts per million. These quality requirements apply to parts at the beginning of the assembly or repair process. Any procedure or methodology that achieves this defect rate is acceptable. The Air Force or its designated contractor will check part defect rates at its discretion to determine if the proper defect rate has been achieved.

## 5. PLANNING FOR ESS

5.1 The production ESS program should be designed or tailored to your specific program. If it is deemed that ESS is needed, all initial ESS parameters should be determined in advance of the screening. Once screening has begun, the FRACAS should be used to obtain information to determine if the screen should be tailored. The ESS parameters are based on surveys and analyses of the response of the equipment to the ESS stimuli. The equipment is not designed to the screen; the screen is designed to the equipment.

5.1.1 Production ESS is not intended to detect design flaws. However, using the ESS regimen on production and/or pre-production items may well disclose design deficiencies.

5.1.2 ESS during design and/or early repair phases is used to define and plan a cost-effective screening program for the production phase.



5.2 ESS is conducted during production on all levels of assembly (i.e., LRU, LRM, SRU) prescribed by the contract. Results of the screening are recorded through FRACAS for corrective actions. The ESS process should not be initialized and started over after failures; some failures may occur on every cycle, but the incidence of those failures should decrease on each succeeding cycle.

5.3 ESS should be considered for "bad actors." Problems with systems, subsystems, or configuration items that exhibit high retest OK (RTOK) rates can often be purged by performing ESS on the item during the repair process. Where ESS is indicated (i.e., evidence of infant mortality), the repair and management activities must establish an ESS program. All ESS programs should be designed using the guidelines established in this document.

5.3.1 The cognizant engineer has the responsibility of assuring that the contractor and/or repair activity has developed the ESS profiles in accordance with prescribed practices and the guidelines established in this document.

5.3.2 Your division R&M/ESS Focal Point and the SM-ALC ESS Program Manager are available for consultation on the screening program requirements.

## 6. TAILORING ESS

6.1 General Recommendations. Section 4.3 contains the R&M 2000 ESS guidelines. These guidelines are only recommendations for the base line screening programs. The guidelines may be appropriate for your program but the actual screen development, which is the responsibility of the contractor and/or repair activity, is accomplished through experimentation. The guidelines are a starting point for designing an ESS regimen.

6.2 Response Characterization. The response characterization which is the response of the hardware to the initial regimen is performed via thermal and vibration surveys.

6.2.1 Thermal Surveys. A thermal survey is the measurement of the thermal response characteristics at points of interest within an equipment when temperature extremes are applied to the equipment. Methods of performing thermal surveys include using infrared comparison and power-on testing or placing thermocouples at points of interest.

6.2.2 Vibration Surveys. A vibration survey is the measurement of vibration response characteristics at points of interest within an equipment when vibration excitation is applied

to the equipment. Vibration surveys can be accomplished using finite-element analysis or by placing accelerometers at points of interest.

### 6.3 Reasons for tailoring an ESS program.

6.3.1 Design. The initial screening regimen should be designed during early contract or repair effort. The screen can then be applied to initial assets and modified, as necessary, to obtain the most effective screening regimen.

6.3.2 Modify. The initial screen can be modified as data becomes available showing the effects of the screens on infant mortality. The ESS process can be strengthened, reduced, or eliminated based on the evidence that the screens are (1) ineffective, (2) are effective but too strong, or (3) have over-time precipitated failures, the causes of which have been eliminated.

### 6.4 Tailoring Techniques.

6.4.1 Initial Guidelines. Begin with established ESS guidelines, apply stated profiles to initial assets, analyze the results, and adjust the screens as required. The R&M 2000 ESS regimen may be used as part of a step-stress or other experimental procedure to help establish the proper screens for production.

6.4.2 Step-Stress Analysis. Step-stress analysis is an accepted ESS design or tailoring technique. In step-stress, progressively stronger screens are run on test articles until the strength that precipitates a large percentage of the screenable defects is reached. As each failure occurs, failure analysis is conducted to determine the cause of the failure. If it is determined that the failure is a workmanship or a part problem, the item is repaired and the ESS regimen is increased. This procedure is continued until a defect which would not otherwise be expected to occur in the field and which is induced by the screening parameter appears. At this point, the item is again repaired and the ESS parameter is decreased. We have reached the design limit of the item. This is the level at which we will proceed with the screening program. The experiments may involve introducing known defects into the test items to ensure that the screens are precipitating the desired defects. The final strength of the screen should be above the operational environment but within the design limits of the item.

6.4.3 Previous Contractor Experience. Many defense contractors have performed ESS as part of other defense contracts. They have invested in screening equipment and developed internal structures for ESS on the types of equipment they build. These

contractors should be allowed to apply and tailor their own methods to the current contract requirements.

6.4.4 Strength Models. Strength models can be used to predict the effects of a particular screen regimen when there is no data to show field effects. The strength is a predictor of a number of defects that a particular screen with an analytical strength should precipitate. The incoming latent defect density is estimated and screens are selectively placed at various assembly levels to develop a plan for achieving quantitative ESS goals cost-effectively. The strength model compels the designer to estimate the number of defects expected in the product, and thereby encourages him to analyze the quality factors of parts and manufacturing processes. Refer to DOD-HDBK-344 for further information.

6.4.5 Total Time on Test (TTT). The TTT method yields useful information on the effectiveness of the screens. TTT graphically displays the incidence of infant mortality that ESS is designed to reduce or eliminate. Given the test time or usage time of equipment and times to failure, the TTT plots display the hazard function of the equipment which gives the indication of the failure rate. Refer to MIL-HDBK-781 for TTT methods.

## 7. RESPONSIBILITIES

7.1 Branch Chief's (or comparable level of supervision) Responsibilities. The branch chief shall be responsible for ensuring that adequate ESS provisions are incorporated into the procurement process.

7.2 Engineer's Responsibilities. The cognizant engineer shall be responsible for developing the specification in accordance with paragraph 8.5.1 of this handbook.

7.3 Equipment Specialist's (ES) and/or Program Manager's Responsibilities. The ES and/or program manager shall be responsible for developing the Statement of Work (SOW) in accordance with paragraph 8.5.2 of this handbook.

7.4 Joint Responsibilities. The engineer shall work with the ES and/or program manager to develop the contract data requirements list in accordance with paragraph 8.5.3 of this handbook.

## 8. CONTRACTING FOR ESS (INCLUDING ORGANIC MANUFACTURING)

### 8.1 Design of an Effective ESS Program

8.1.1 The contractor should have the flexibility to design an

initial set of screens (or tailor an initial base line regimen) based on factors such as manufacturing process maturity, hardware characteristics, facilities considerations, and company standards.

8.1.2 The contractor should modify the ESS regimen during production runs based on the results of previous screening, and the extent to which the company/repair activity is making corrections to reduce the recurrence of latent defects. ESS tailoring and modification can be based on technical judgement, not strict contractual language.

8.2 ESS Certification. The activity initiating the purchase request shall certify whether or not ESS is required (Refer to Appendix F for Certification Form and Certification Flowchart).

8.2.1 ESS Certification for New Acquisitions. ESS shall be included on all purchase requests (PRs) for electronic items except those that satisfy one or more of the following criteria.

8.2.1.1 The PR is less than \$100,000 beginning in FY88, less than \$50,000 beginning in FY89, less than \$25,000 beginning in FY90 and less than \$10,000 beginning in FY91.

8.2.1.2 The PR is for an electronic component (e.g., transistor, resistor, diode, integrated circuit, etc.) which has a defect rate less than 100 parts per million.

8.2.1.3 The item to be procured is commercial off-the-shelf equipment used in a benign environment (i.e., nonmobile, temperature controlled environment).

8.2.1.4 The quantity of items to be procured is less than ten.

8.2.1.5 The PR is for an Engineering Service Contract

8.2.1.6 The PR is for a Foreign Military Sales Contract.

8.2.1.7 The PR is for a rebuy of an item presently in the inventory which has a high reliability.

8.2.2 ESS Certification for Repaired Items. ESS shall be included on all electronic items repaired (either organically or contractually) except those that satisfy one or more of the following criteria.

8.2.2.1 The item is an aircraft.

8.2.2.2 The estimated annual repair cost is less than \$100,000 beginning in FY88, less than \$50,000 beginning in FY89,

less than \$25,000 beginning in FY90 and less than \$10,000 beginning in FY91.

8.2.2.3 The item is a TO 00-25-107 (Maintenance Assistance of Aircraft) requirement.

8.2.2.4 The item is a TO 00-25-108 (Communications-Electronics Depot Support) requirement.

8.2.2.5 The annual quantity of items to be repaired is less than ten.

8.2.2.6 The item is repaired by a foreign military sales contractor.

8.2.2.7 The item is repaired by a non Air Force federal agency.

8.2.2.8 The item is repaired by either the Lakenheath Specialized Repair Activity or the Cannon Specialized Repair Activity.

8.2.2.9 The item is repaired by a contract field team.

8.2.3 Waiver Authority. If paragraphs 8.2.1 and 8.2.2 indicate that ESS is required, but the engineer desires a waiver (for any reason), the waiver must be approved by either the Division R&M/ESS Focal Point or the SM-ALC ESS Program Manager. The engineer shall provide rationale and/or justification for the requested waiver.

8.3 Organic Manufacturing. ESS shall be required on all printed circuit boards manufactured in the Directorate of Maintenance (MA). The tasking to MA shall include development of the screening profile. The screening profile shall be approved by the cognizant engineer in the Directorate of Materiel Management (MM). Once approved and verified, all items shall be screened prior to delivery to the customer.

#### 8.4 Organic Repair - Special Requirements.

8.4.1 ESS Selection Matrix. All items that are to be repaired organically shall be prioritized using the ESS Selection Matrix (Appendix G). The matrix gives a numerical score to determine the priority. The score ranges from "Disqualification" on the low end to "30" points on the high end of the scale. All items shall be considered for ESS except those that "Disqualify" (i.e., the number of units repaired/year is less than ten, the remaining life of the unit is less than 1 year, the annual repair cost of the national stock number (NSN) is less than \$10,000).

8.4.2 ESS Decal. All items that are screened organically shall have an ESS Decal affixed. This decal, which is available through the ESS program office or from any ESS focal point will contain the following information:

- a. Date screened
- b. Serial number of the item
- c. The organization to notify in case of a failure

8.4.2.1 In the case of a field failure, the appropriate organization as indicated on the decal (e.g., the inventory management specialist (IM), should be notified prior to field repair or return to depot. The IM shall request the following information from the field:

- a. The NSN of the Assembly
- b. Serial Number of the Assembly
- c. Date of failure occurrence
- d. Number of hours of operation since date of screening
- e. Environmental conditions at time of failure
- f. Symptom of failure
- g. What failed, if known
- h. Is field repair of the assembly possible?

8.4.2.2 This information shall be compiled by the cognizant engineer in accordance with guidelines provided at a later date. In addition, the IM and/or ES shall provide the field with the appropriate disposition instructions in accordance with guidelines provided at a later date.

## 8.5 Contract Provisions

### 8.5.1 Specification Requirements

8.5.1.1 Specification Language. ESS shall be contractually required by entries in the contract specification for equipment at the LRU level, LRM level and SRU level of assembly. It is imperative that the screening requirements be contained in specification sections 3 and 4.

8.5.1.1.1 Specification Section 3. Under the requirements of this section, there shall be a numbered paragraph entitled "Environmental Stress Screening (ESS)" which may read as follows:

"3.X.X.X Environmental Stress Screening (ESS). All (describe equipment to be procured) equipment produced/repaired shall be environmentally stress screened to disclose manufacturing and part defects and otherwise to reduce or eliminate infant mortality failures. ESS shall be accomplished in accordance with paragraph 4.X.X.X of this specification."

8.5.1.1.2 Specification Section 4. Under the requirements of this section, there shall be a numbered paragraph entitled "Environmental Stress Screening (ESS)" which may read as follows:

"4.X.X.X Environmental Stress Screening (ESS). The contractor shall environmentally stress screen the equipment produced/repaired in accordance with the following guidelines."

The paragraph or subparagraph(s) which follow in section 4 of the equipment specification shall include the general ESS guidelines as outlined in sections 4.3 through 4.3.3 of this handbook, tailored for your commodity.

8.5.1.2 Specification Examples. Appendix A contains several examples of specifications prepared by the Directorate of Materiel Management engineers which have been changed to the proper format (refer to MIL-STD-490A and Appendix H for the preparation procedures). These examples give helpful hints on how you may develop specifications and how ESS may be tailored to your specific commodity items. These examples may not be optimum and perhaps they can be improved upon, but they are a starting point for developing your specification.

## 8.5.2 Statement of Work (SOW) Requirements

8.5.2.1 SOW Language. The following paragraphs provide SOW requirements for ESS. Any task identified in the SOW taken from applicable documents (MIL-SPECs, MIL-STDs, etc.) shall specify details as required by that document. The SOW preparer shall tailor the following paragraphs for the particular program.

8.5.2.1.1 The contractor shall develop and implement an effective environmental stress screening (ESS) program to apply harsh environments to identify and precipitate manufacturing defects. The objective of the ESS program is to eliminate manufacturing problems which degrade product performance from its

design capability and through design and/or production process changes to improve product reliability.

8.5.2.1.2 The contractor shall develop an ESS program that is integral to product development and production and is a closed-loop process of problem precipitation, analysis and corrective action to eliminate defect causes. The contractor shall specify his ESS process for the particular product to be procured and define his rationale for selecting an initial screening regimen in the ESS Implementation Plan, hereafter referred to as the plan (DI-RELI-80250 paragraph 10.3.w).

8.5.2.1.2.1 The contractor shall screen all (i.e., 100 percent) of the deliverable items procured and/or repaired under this contract.

8.5.2.1.2.2 The contractor shall use R&M 2000 ESS Guidelines which are included in the equipment specification as a starting point to develop initial screening regimens for the particular product to be screened. The contractor shall describe in the plan how this regimen will be an effective screen, but not destroy or significantly reduce product service life.

8.5.2.1.2.3 The following tasks shall be accomplished by the contractor as he implements his screening program.

a. All LRUs/LRMs shall undergo both random vibration and thermal cycling during ESS.

b. For LRU/LRM procurements, SRUs need not be vibrated individually during ESS. However, SRUs purchased as spares shall undergo the same vibration as the associated LRU/LRM.

c. The equipment to be screened shall be functionally monitored using the appropriate test equipment prior to the beginning of ESS to make sure that it is operating according to specifications. The equipment shall also be functionally monitored at the conclusion of ESS to make sure that it is still operating according to specifications.

d. All equipment at the LRU/LRM level, if possible, shall be operating, installed in its normal orientation with protective covers removed.

e. All equipment at the SRU level need not be operating during ESS, but all protective covers and cases shall be removed.

f. Thermocouples to measure temperature response and/or accelerometers to measure vibration response shall be placed on



the item(s) being screened. It is imperative that the response characteristics are sensed on the item(s) being screened.

g. All LRUs/LRMs shall be monitored continuously during ESS. Many failures that occur are intermittent and can only be detected if the LRU/LRM is monitored. SRUs need not be monitored during ESS.

h. All failures that occur during ESS shall be analyzed to determine the cause of failure. Appropriate corrective action shall also be a part of the ESS program. One method of doing this is by means of a FRACAS as described in MIL-STD-785B Task 104.

i. After a failure has occurred and the failure has been isolated and corrected, the item shall be operated and its performance monitored to ensure proper diagnosis and correction.

j. Failure free tests are not appropriate for ESS. If an item fails and is repaired, it need only be screened for what remains of its original screening program, providing a minimum of 25 percent of the original screen remains. If 25 percent of the original screen does not remain, the appropriate number of cycles shall be added to the screening program such that failure-free cycles constitute a minimum of 25 percent of the screening program.

8.5.2.1.3 The following items shall be included in the ESS Implementation Plan (DI-RELI-80250):

8.5.2.1.3.1 Screening Process Requirements.

8.5.2.1.3.1.1 The objective of the ESS process is to eliminate manufacturing problems which degrade product performance from its design capability and thus improve product reliability. The ESS implementation plan and procedures will show how the contractor's approach to applying ESS is an integral part of hardware development and production. The plan will show how the process is a closed-loop system of problem detection, analysis and corrective action to eliminate defect causes.

8.5.2.1.3.1.2 The plan shall describe how experimentation with different types, combinations, levels and duration of screens during product development will be used to help develop preliminary screening regimens.

8.5.2.1.3.1.3 The contractor shall describe how preliminary screening regimens will be used on brassboard or full scale engineering development hardware to identify potential production process problems early in the program. Design problems may also be detected although this is not the intent of ESS.

8.5.2.1.3.1.4 The plan shall show production process flow through screening, including functional testing before and after screening, the screening processes themselves, troubleshooting and repair of failed items, failure analysis and corrective actions.

8.5.2.1.3.1.5 The plan shall show how using other vendors' products, lot rejections, production engineering changes, and items design charges will be used as effective tools to take action and eliminate defects.

8.5.2.1.3.1.6 The plan shall specify how the contractor will assure that the screening requirements, procedures and evaluation methods will be maintained and updated as the process changes. The contractor shall define how the information will be accurately transferred to follow-on production requirements, future reprocurments of spare parts and potential transition to competitive procurements from other manufacturing divisions or contractors.

#### 8.5.2.1.3.2 Screen Development.

8.5.2.1.3.2.1 The plan shall include a detailed description of the initial regimen selected for each item and each level of assembly of that item. The initial regimen selected should be based on tailoring the USAF R&M 2000 ESS Guidelines specified in the contract to the product to be screened to achieve the most effective screen technically possible. As a minimum, the plan shall specify the following parameters for the initial regimen:

- a. Vibration type and method of generation
- b. Vibration level(s) over the required frequency range
- c. Duration of vibration (minimum)
- d. Axes to be stimulated (serially or concurrently)
- e. Methodology of measuring and controlling vibration response
- f. Temperature extremes (high, low). The important consideration is the temperature extreme of the UUT
- g. Maximum rates of temperature change for the UUT
- h. Number of temperature cycles (minimum)
- i. Temperature cycle duration and dwell times at the temperature extremes

j. Methodology for measuring and controlling thermal response

k. Equipment power ON/OFF during each screen

l. Equipment operation during screening (including duty cycles, mode of operation and methods of testing equipment for correct operation during screening).

8.5.2.1.3.2.2 The contractor shall explain his methodology used to select the specific types, sequence, level, and duration of screen. The methodology can be analytical (including engineering analysis or statistical techniques), experimental (stressing at different levels to find the optimum defect detection level) or interpretive (applying starting regimens proven to be successful on similar hardware designs). The plan shall include any analytical methods, procedures and the data derived required to determine the best stress levels to detect the most defects for the particular hardware under screening. This information includes:

a. Engineering analysis of screening stresses on the hardware under screening (showing maximum screen strength vs design limits).

b. Analytical calculations to estimate screen strength required to maximize defect detection.

c. Results of experimental screening at different levels, rates and durations on the article to be screened.

d. Results and analysis of previous screening programs on the hardware to be produced.

e. Results and analysis of successful screening regimens used on similar hardware designs (including analysis of similarity and differences between the two items and why the similar screening regimen is applicable).

8.5.2.1.3.2.3 The chamber(s) that the contractor uses shall be large enough to contain at least one of the items being screened and they shall be capable of vibration and/or thermal cycling depending upon the screening scenario.

8.5.2.1.3.3 ESS Procedures. The ESS procedures shall give detailed requirements as to how the contractor shall accomplish the ESS program. The procedures shall contain step-by-step instructions of how the equipment involved in the screen (e.g.,

the units under test, test chambers, the monitoring equipment, etc.) will be used during the screening program.

8.5.2.1.3.3.1 Information Required.

a. A list of the equipment that will be screened, including the level of screening (i.e., LRU, LRM, SRU).

b. Equipment that will be used to functionally monitor the item(s) being screened. The manufacturer's model number of the monitoring equipment shall be annotated.

c. Thermal surveys and/or vibration surveys of the item(s) to be screened, if available, shall be provided. An analysis of these surveys, which will help to establish the vibration and temperature stabilization points, shall also be provided.

8.5.2.1.3.3.2 Detailed Procedures.

a. Performance parameters to be measured, limits, frequency of measurement, method, and under what environmental conditions shall be included.

b. A sketch of the operational configuration and/or equipment orientation of the items being screened shall be included.

c. A sketch of the thermocouple and accelerometer hook-up on the items being screened shall be included.

8.5.2.1.4 The contractor shall report screening results for each deliverable item (DI-RELI-80249/T).

8.5.2.1.5 The contractor shall use electronic components (piece-parts) in the production or repair process with defect rates below 100 parts per million. The contractor may use any procedure or methodology that achieves this defect rate.

8.5.2.1.5.1 If the contractor operates an in-house screening program to rescreen parts purchased from the original manufacturer or parts suppliers, the plan shall identify the following information for the parts used on this program:

a. Part type

b. Part numbers; manufacturers

c. Specifications parts will be rescreened to

- d. Method(s) of determining defect rates
- e. Methods of controlling and storing screened parts
- f. Procedures for identifying failed parts for detailed failure analysis.
- g. Requirements and methods for implementing corrective actions based on screening fall out and detailed failure analysis.

8.5.2.1.5.2 The contractor shall define in the plan how he will validate that the parts source does indeed provide the stated quality level.

8.5.2.1.6 The contractor shall analyze the results of the screening process to determine what modifications (i.e., modification of screen levels or duration, addition or deletion of screens, etc.) should be made to make the screen more effective. The contractor shall support the recommendations with detailed rationale and data. The contractor shall use the ESS report to suggest modifications and will propose formal changes to the plan for approval by the procuring agency.

8.5.2.2 SOW Examples. Appendix B contains several examples of SOWs prepared by the Directorate of Materiel Management personnel which have been changed to the proper format (refer to MIL-HDBK-245B and Appendix H for the preparation procedures). These examples give helpful hints on how you may develop SOWs and how ESS may be tailored to your specific commodity items. These examples may not be optimum and perhaps they can be improved upon but they are a starting point for developing your SOW.

#### 8.5.3 Contract Data Requirements List

8.5.3.1 DI-RELI-80250/T Reliability Test Plan (Refer to Appendix C for the data item and a sample AF Form 585).

8.4.3.2 DI-RELI-80249/T Environmental Stress Screening Report (Refer to Appendix C for the tailored data item and a sample AF Form 585).

8.4.3.2 DI-RELI-80251/T Reliability Test Plan. This data item, although containing ESS provisions, is not suggested as an applicable data item.

### 9. ESS REPORTING REQUIREMENTS

9.1 Quarterly Progress Report. Each operating division in the Directorate of Materiel Management shall submit a

quarterly progress report to the ESS program office. This report, which is due the 15th of the month following the end of the quarter (i.e., 15 April, 15 July, 15 Oct, 15 Jan), shall be prepared by the division ESS focal point and shall contain the following information, as a minimum: (Refer to Appendix D for the report format).

9.1.1 Number of items reviewed

9.1.2 Number of items that require ESS

9.1.3 Number of items with ESS included

9.1.4 Number of engineering projects for incorporation of ESS in future procurements.

9.2 SM-ALC ESS Progress Report. The SM-ALC ESS program office shall compile the information submitted by the ESS Focal Points and prepare an SM-ALC ESS progress report. This report will be submitted to the Director of Materiel Management with copies to each division within the Directorates of Maintenance and Materiel Management. The report is due no later than 45 days after the end of the quarter (i.e., 15 May, 15 Aug, 15 Nov, 15 Feb) (Refer to Appendix E for a sample report).

## APPENDIX A

### SPECIFICATION EXAMPLES

The following are examples of ESS portions of specifications that have been used in the past. These examples have been modified to include information that should be contained in specifications.

#### EXAMPLE 1

### 3. Requirements

#### 3.3 Design and Construction

##### 3.3.1 Materials, Processes and Parts.

3.3.1.1 Environmental Stress Screening (ESS). The radiosondes and windsondes shall be environmentally stress screened in accordance with government approved ESS requirements. The stress screening shall consist of thermal cycling of all radiosonde and windsonde internal electronics (sonde minus battery, sensors, and supporting structures as described in paragraph 4.2.3.

### 4. Quality Assurance Provisions

#### 4.2. Quality Conformance Inspections

4.2.3 Environmental Stress Screening. The contractor shall verify ESS by demonstrating that he can properly perform ESS for 100 percent of all windsondes and radiosondes. The contractor shall identify any failures which suggest design deficiencies, defective parts, processes, or workmanship and assure that all failures are analyzed and processed. The contractor shall use the following stress screening regimen:

Temperature Range (Minimum)	-90 deg C to +68 deg C
Temperature Rate of Change (Minimum, See note 1)	30 Deg C/Min
Temperature Dwell Duration (See note 2)	Until Stabilization
Temperature Cycles (Minimum)	25
Power On/Equipment Operating	No
Equipment Monitoring	No

## Electrical Testing After Screening Yes

Note 1. Use of chambers which will provide the temperature rate of change is desired. However, rapid transfers of the equipment between a chamber at maximum temperature and another chamber at minimum temperature is acceptable.

Note 2. The temperature has stabilized when the temperature of the equipment having the longest thermal lag has met or exceeded the maximum or minimum temperatures for 5 minutes.

### EXAMPLE 2

#### 3. Requirements

##### 3.3 Design and Construction

3.3.8 Environmental Stress Screening. All RLPUs shall be environmentally stress screened as part of the production process in accordance with government approved ESS requirements. The stress screening shall consist of thermal cycling and random vibration as described in paragraph 4.2.1.

#### 4. Quality Assurance Provisions

##### 4.2 Quality Conformance Inspections

4.2.1 Environmental Stress Screening (3.3.8). The contractor shall verify ESS by demonstrating that he can properly perform ESS for 100 percent of all RLPUs. The contractor shall identify any failures which suggest design deficiencies, defective parts, processes, or workmanship and assure that all failures are analyzed and processed. The contractor shall screen 100 percent of all RLPUs produced.

4.2.1.2 Random Vibration Requirements. Vibration ESS shall be random or quasi-random in nature, the key factor in this requirement being that the RLPU be subject to broadband vibration stress across an essentially continuous spectrum from 30 HZ to 200 HZ with 3db roll-off below 100 HZ and above 1000 HZ. The RLPU shall be subject to a random vibration power spectral density of 6 GRMS for 10 min/axis stimulated serially for all three axes.

4.2.1.2 Stress Screening Regimen. The contractor shall use the following stress screening regimen:

Temperature Range (Minimum)	-40 deg C to +60 deg C
-----------------------------	------------------------



Temperature Rate of Change (See Note 1)	5 deg C/min (Minimum,
Temperature Dwell Duration (See Note 2)	Until Stabilization
Temperature Cycles (Minimum)	See Note 3
Power On/Equipment Operating	No
Equipment Monitoring	No
Electrical Testing After Screen	Yes (at ambient Temp)

Note 1. Use of chambers which will provide the temperature rate of change is desired. However, rapid transfers of the equipment between a chamber at maximum temperature and another chamber at minimum temperature is acceptable.

Note 2. The temperature has stabilized when the temperature of the part of the equipment having the longest thermal lag has met or exceeded the maximum or minimum temperature for 5 minutes.

Note 3. A minimum of six thermal cycles shall be completed after random vibration.

### EXAMPLE 3

#### 3. Requirements

##### 3.3 Design and Construction

##### 3.3.1 Materials, Processes, and Parts

3.3.1.4 Environmental Stress Screening (ESS). All deliverable equipment shall be environmentally stress screened in accordance with the government approved ESS requirements.

##### 3.3.1.4.1 ESS Conditions

a. All equipment at the LRU level shall be installed in an operational configuration.

b. Simultaneous vibration and temperature stress screening is desired but not required. If temperature and vibration are applied separately, it is required that vibration occur prior to the temperature cycle.

c. Triaxial random vibration is required at the SRU and LRU

levels. If triaxial vibration equipment is not available, the equipment must be rotated and vibrated for an equal amount of time in each axis.

d. The equipment performance shall be verified both before and after ESS. If a failure has occurred and the failure has been isolated and corrected, the equipment shall be operated and its performance monitored to ensure proper diagnosis and correction.

e. BIT capabilities shall be utilized to the maximum extent to aid in the performance monitoring; however BIT, shall not be the sole means of monitoring performance.

f. Equipment having had ESS failures and having been repaired must subsequently complete the remaining screening process without ESS failures before being declared serviceable. If the remainder of the screening process has fewer than five thermal cycles, the process shall be extended until the equipment has completed at least five ESS failure-free thermal cycles before being declared serviceable.

3.3.1.4.2 Failure Reporting, Analysis, and Corrective Action System (FRACAS). The contractor shall use a closed-loop system to collect data, analyze, and record timely corrective action for all failures that occur during ESS.

3.3.1.4.3 Sampling. One hundred percent of all units designed, developed and manufactured (including prototypes shall undergo ESS.

#### 4. Quality Assurance Provisions

##### 4.2 Quality Conformance Inspections

##### 4.2.7 Environmental Stress Screening Requirements

##### 4.2.7.1 Thermal Requirements

###### a. Temperature Range

- |                  |                       |
|------------------|-----------------------|
| 1. SRU Level:    | From -54 to +85 Deg C |
| 2. LRU Level:    | From -54 to +71 Deg C |
| 3. System Level: | From -54 to +71 Deg C |

###### b. Temperature Rate of Change (See Note 1)

- |                  |              |
|------------------|--------------|
| 1. SRU Level:    | 30 Deg C/Min |
| 2. LRU Level:    | 5 Deg C/Min  |
| 3. System Level: | 5 Deg C/Min  |

c. Temperature Dwell Duration (See Note 2)

- |                  |                     |
|------------------|---------------------|
| 1. SRU Level:    | Until Stabilization |
| 2. LRU Level:    | Until Stabilization |
| 3. System Level: | Until Stabilization |

d. Temperature Cycles (See Note 3)

- |                  |           |
|------------------|-----------|
| 1. SRU Level:    | 25 Cycles |
| 2. LRU Level:    | 10 Cycles |
| 3. System Level: | 5 Cycles  |

e. Power On/Equipment Operating

- |                  |                |
|------------------|----------------|
| 1. SRU Level:    | No             |
| 2. LRU Level:    | See Note 4     |
| 3. System Level: | Not Applicable |

f. Equipment Monitoring

- |                  |                |
|------------------|----------------|
| 1. SRU Level:    | No             |
| 2. LRU Level:    | See Note 5     |
| 3. System Level: | Not Applicable |

g. Electrical Testing After Screen

- |                  |                       |
|------------------|-----------------------|
| 1. SRU Level:    | Yes (at ambient temp) |
| 2. LRU Level:    | Yes (at ambient temp) |
| 3. System Level: | Yes (at ambient temp) |

4.2.7.2 Random Vibration Requirements. See Note 6)a. Power Spectral Density (See Note 7)

- |                  |                           |
|------------------|---------------------------|
| 1. SRU Level:    | 6 GRMS (100HZ to 1000 HZ) |
| 2. LRU Level:    | 6 GRMS (100HZ to 1000 HZ) |
| 3. System Level: | Not Applicable            |

b. Axes stimulated serially or in combination

- |                  |                          |
|------------------|--------------------------|
| 1. SRU Level:    | 2 (Minimum) (See Note 8) |
| 2. LRU Level:    | 3                        |
| 3. System Level: | Not Applicable           |

c. Duration of Vibration

- |                  |                |
|------------------|----------------|
| 1. SRU Level:    | 10 min/axis    |
| 2. LRU Level:    | 10 min/axis    |
| 3. System Level: | Not Applicable |

d. Power On/Equipment Operating

- |                  |                |
|------------------|----------------|
| 1. SRU Level:    | No             |
| 2. LRU Level:    | See Note 4     |
| 3. System Level: | Not Applicable |

e. Equipment Monitoring

- |                  |                |
|------------------|----------------|
| 1. SRU Level:    | No             |
| 2. LRU Level:    | See Note 5     |
| 3. System Level: | Not Applicable |

4.2.7.3 Notes

a. Note 1: Use of chambers which will provide the temperature rate of change is desired. However, rapid transfers of the equipment between a chamber at maximum temperature and another chamber at minimum temperature is acceptable.

b. Note 2: The temperature has stabilized when the temperature of the part of the equipment having the longest thermal lag has met or exceeded the maximum or minimum temperatures for 5 minutes.

c. Note 3: A minimum of five thermal cycles must be completed after the random vibration screen if thermal cycling and random vibration are not run concurrently.

d. Note 4: Operation shall occur during the low to high temperature excursion of the chamber and during vibration. Equipment shall be operating at maximum power loading. Power will be OFF on the high to low temperature excursion until stabilized at the low temperature. Power will be turned ON and OFF a minimum of three times at temperature extremes on each cycle.

e. Note 5: Instantaneous go/no-go performance monitoring during the stress screen is essential to identify intermittent failures. If such monitoring cannot be performed for one level of assembly, ESS will be performed on the next higher level of assembly, but using ESS specifications of the lower assembly, if they are more severe.

f. Note 6: Simultaneous random vibration and temperature

stress screening is desired but not required. When temperature and vibration are applied separately, it is required that vibration occur prior to the temperature cycle. Required vibration levels are a response function and will be measured by accelerometers placed on the items being screened.

g. Note 7: When quasi-random vibration is applied at the LRU level, random vibration is not required at the SRU level. However, subassemblies purchased as spares are required to undergo the same vibration required for the LRU level. An "LRU mock-up" or equivalent approach is acceptable.

h. Note 8: For an SRU, such as a printed circuit card, if only two axes are stimulated, one axis stimulated should be perpendicular to the plane of the card, to assure that we are not just screening two basically symmetric axes and missing a critical orientation.

#### 4.2.7.4 General Instrumentation Requirements.

a. Real time on-line data shall be obtained for all critical performance parameters (e.g., vibration, g level and frequency, temperature, equipment power level, equipment performance, etc.)

b. Continuous permanent records of all ESS conditions shall be provided.

c. All instrumentation shall be within the calibration interval of the equipment. The instrumentation shall also be operational and recording prior to applying power to ESS equipment.

## APPENDIX B

## STATEMENT OF WORK (SOW) EXAMPLES

The following are examples of ESS portions of SOWs that have been used in the past. In certain cases these SOWs have been modified to include information that should be included in SOWs.

EXAMPLE 1

1. Scope. This appendix describes the requirements for the implementation of an ESS program applicable to the TER-102 Reconstitution Radio.

1.1 Definitions

1.1.1 Environmental Stress Screening (ESS). A process wherein specific types of environmental stresses are applied to an item on an accelerated basis, but within the design capability, in order to precipitate latent flaws to failure, prior to placing the item in the field.

1.1.2 Line Replaceable Unit (LRU): An assembly or module which can be removed and replaced at the organization level without cutting, unsoldering, unwrapping or otherwise requiring more disassembly than screws or connectors.

2. Applicable Documents3. Requirements3.3 Environmental Stress Screening (ESS)

3.3.1 ESS Level: The contractor shall perform ESS on the TER-102 reconstitution radio down to the LRU level as a minimum requirement.

3.3.2 Temperature Cycling: The ESS performed by the contractor on the TER-102 shall contain temperature cycling over the range of -30C to +70C. A temperature cycle shall consist of starting at ambient temperature, cycling through the temperature extremes, and returning to ambient temperature.

3.3.2.1 Temperature Change: The ESS performed by the contractor

shall have a minimum rate of temperature change of 10 degrees C per minute.

3.3.2.2 Dwell Time: The low and high temperature in the contractor-performed ESS shall be maintained for a minimum of 30 minutes during each temperature cycle.

3.3.2.3 Power Loading: Power shall be on during the low to high temperature excursion with the equipment at maximum power loading. The power shall be off during the high to low temperature excursion until the equipment has stabilized at the low temperature.

3.3.3 Vibration: The contractor-performed ESS shall have a vibration cycle consisting of quasi-random vibration with a spectral density of 6 GRMS within the frequency limits of 100-1000 HZ.

3.3.3.1 Duration: The ESS vibration cycle shall have a minimum duration of 30 minutes at 10 minutes/axis stimulated serially or 10 minutes overall when all three axes are stimulated concurrently.

3.3.3.2 Power Loading: The power to the equipment shall be at maximum power loading during the vibration cycle of the contractor performed ESS.

3.3.4 ESS Cycle: The contractor-performed ESS cycle shall consist of five temperature cycles followed by a vibration cycle followed by another five temperature cycles.

3.3.5 Performance Monitoring: The contractor-performed ESS shall include contractor-written, government-approved procedures for instantaneous performance monitoring during the stress screen to identify intermittent failures when the power is on.

3.3.6 ESS Acceptance: The contractor shall subject each LRU to a contractor-written, government-approved test to exercise all the capabilities of the LRU following ESS.

## EXAMPLE 2

1. Scope

2. Applicable Documents

3. Requirements

3.3 Environmental Stress Screening (ESS). The contractor shall

develop and implement an effective ESS program to apply harsh environments to identify and precipitate manufacturing defects. The objective of the ESS program is to eliminate manufacturing problems which degrade product performance from its design capability and through design and/or production process changes to improve product reliability.

3.3.1 The contractor shall develop an ESS program that is integral to product development and production and is a closed-loop process of problem detection, analysis, and corrective action to eliminate defect causes. The contractor shall specify his ESS process for the particular product to be procured and define his rationale for selecting an initial screening regimen (DI-RELI-80250)

3.3.1.1 The contractor shall initially screen all (100 percent) deliverable items procured under this contract.

3.3.1.2 The contractor shall use component electronic parts (piece-parts) in the production or repair process with defect rates below 100 parts per million. The contractor may use any procedure or methodology that achieves this defect rate.

3.3.1.3 The contractor shall use the R&M 2000 ESS Guidelines which should be included in the equipment specification as a starting point to develop initial screening regimens for the particular product to be screened. The contractor shall explain in detail rationale for selection of an initial screening regimen for the particular product and provide data to support this decision. The contractor shall explain how this regimen will be an effective screen but not destroy or significantly reduce product service life.

3.3.2 The contractor shall analyze screening results to determine causes of the failures for corrective action. The ESS process shall be a closed-loop system of problem precipitation, identification, analysis, and corrective action. The contractor shall analyze the results of the screening process to determine what modifications (i.e., modification of screen levels or duration; addition or deletion of screens) should be made to make one screen more effective. The contractor shall support the recommendations with detailed rationale and data. The contractor shall use the ESS report to suggest modifications and will propose formal changes to the plan for approval by the procuring agency (DI-RELI-80249, DI-RELI-80250).



15 June 88

APPENDIX C  
ESS DATA ITEM DESCRIPTIONS

# DATA ITEM DESCRIPTION

Form Approved  
OMB No. 0704-0188

## 2. TITLE

Reliability Test Plan

## 1. IDENTIFICATION NUMBER

DI-RELI-80250

## 3. DESCRIPTION/PURPOSE

3.1 This plan describes the overall reliability test planning and its relationship to the total integrated test requirements. It delineates required reliability tests, their purpose and schedule. This document will be used by the procuring activity for review, approval, and subsequent surveillance and evaluation of the contractor's reliability test program.

## 4. APPROVAL DATE (YYMMDD)

861017

## 5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

EC

## 6a. DTIC APPLICABLE

## 6b. GIDEP APPLICABLE

## 7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for the Reliability Test Plan required by Tasks 101, 103, 202, 301, 302 and 401 (para 401.2) of MIL-STD-781D.  
7.2 This DID is applicable to contracts which require reliability development/growth, qualification or production acceptance tests.  
7.3 This DID is related to DI-RELI-80251 , Reliability Test Procedures; DI-RELI-80252 , Reliability Test Report; and DI-RELI-80249 , Environmental Stress Screening Report.  
7.4 This DID supersedes DI-R-7033.

## 8. APPROVAL LIMITATION

## 9a. APPLICABLE FORMS

## 9b. AMSC NUMBER

N3982

## 10. PREPARATION INSTRUCTIONS

10.1 Reference documents. The applicable issue of the documents cited herein, including their approval dates, and dates of any applicable amendments and revisions, shall be as reflected in the contract.  
10.2 General.

a. The Reliability Test Plan shall identify and describe planned contractor activities for implementation of reliability test and ESS requirements of the contract in relationship to MIL-STD-781.

b. The Plan shall be a detailed refinement and expansion of the demonstration section of the Reliability Program Plan when applicable.

10.3 Content requirements. The plan may be prepared in the contractor's format and shall contain a complete listing of all tests to be conducted for the primary purpose of obtaining data for use in reliability analysis and evaluation of the contract item or any constituent elements thereof. The plan shall be prepared in accordance with the requirements of paragraph 4.1, 4.2 and Task 101 of MIL-STD-781. The test plan shall include the following:

- a. Test objectives and requirements of each reliability test.
- b. Test item configuration description and quantity to be tested.
- c. Test conditions, environmental, operational and performance profiles, and the duty cycle.

## 11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

10. PREPARATION INSTRUCTIONS (Cont'd)

- d. Reliability growth planning curve.
- e. Test schedules and milestones, including the test program review schedule.
- f. Specific statistical test plan.
- g. Test conduct ground rules, failure criteria, and interface boundaries.
- h. Test facility and equipment descriptions and requirements, including provisions for monitoring input voltage, temperature, and vibration.
- i. Government Furnished Property requirements and impact.
- j. Limited life items.
- k. List of test reports to be issued.
- l. Failure recurrence control system to be used to ensure corrective action.
- m. List of test procedures required.
- n. Definition of items termed replaceable at failure.
- o. Detailed reason for each proposed deviation.
- p. Degree of contractor and procuring activity participation as approved by the procuring activity.
- q. Assignment of specific responsibilities.
- r. Access control to test area and equipment under test.
- s. Specific contractor/procuring activity organizational element with respective authorities and responsibilities for implementation of reliability testing as mutually agreed to and approved by the procuring activity.
- t. Allocated funds or man-months.
- u. Organizational lines of communication.
- v. Planned man-loading for the test and associated activities.
- w. ESS implementation plan.

# CONTRACTOR DATA REQUIREMENT SUBSTANTIATION

I. IDENTIFICATION													
CONTRACT/PR NUMBER		SYSTEM/ITEM											
II. DD FORM 1423 ENTRIES													
1. SEQUENCE NO	2. TITLE OR DESCRIPTION OF DATA	3. SUBTITLE	4. AUTHORITY (Data Item Number)	5. CONTRACT REFERENCE	6. TECHNICAL OFFICE	7. DD 250 REQ	8. APPR CODE	9. IN. PUT TO IAC	10. FREQUENCY	11. AS OF DATE	12. DATE OF 1ST SUBMISSION	13. DATE OF SUBSEQUENT SUBM/ EVENT IDENT	14. DISTRIBUTION AND ADDRESSES (Address Regular/rep/ro copies)
	Reliability Test Plan	ESS Implementation Plan			ONE/R						Item 16		
											Item 16		
15. TOTAL													
16. REMARKS													
Blk (11) (12) (13) Plan shall be submitted NLT 30 days prior to the start of ESS as required in the SOW. Approval NLT 10 days prior to start of screening.													
III. JUSTIFICATION/TAILORING/DISPOSITION													
17. JUSTIFICATION: STATE HOW THE DATA WILL BE USED, WHO WILL USE IT, AND THE IMPACT IF IT IS NOT OBTAINED.													
a. The data will be used to evaluate the contractor's proposed ESS program to use harsh environments to eliminate manufacturing defects which degrade product performance from its design capability and through design changes improve product reliability.													
b. The data will be used by: (1) Cognizant Engineer (2) Reliability Engineer/MMEAR													
c. Without this data the proposed ESS program cannot be evaluated as appropriate for the equipment procured under this contract. An inadequate ESS program would result in the delivery of unreliable equipment or damaging good equipment.													
* Distribution statement required in accordance with AFR 80-45.													
18. CHECK APPLICABLE BOX(ES)													
CONTRACTOR FORMAT ACCEPTABLE													
DID REQUIREMENTS TAILORED													
DELIVERY CAN BE DEFERRED													
19. REQUESTER IDENTIFICATION													
NAME													
ORGANIZATION													
PHONE													
DATE													
20. DATA REQUIREMENTS REVIEW BOARD DISPOSITION													
<input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED <input type="checkbox"/> OTHER													
REMARKS													
DATE												SIGNATURE	

DATA ITEM DESCRIPTION			Form Approved OMB No 0704-0188	
2. TITLE		1. IDENTIFICATION NUMBER		
ENVIRONMENTAL STRESS SCREENING (ESS) REPORT		DI-RELI-80249		
3. DESCRIPTION/PURPOSE 3.1 This report is a formal record of the contractor's environmental stress screening results. It is used by the procuring activity to evaluate the effectiveness of the contractor's ESS program, to monitor ESS results, and as a basis for ESS-related evaluations and decisions.				
4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE	
861017	EC			
7. APPLICATION/INTERRELATIONSHIP 7.1 This DID contains preparation instructions for ESS reports generated under Task 401 of MIL-STD-781D, Task 301 of MIL-STD-785B, or other contractual ESS requirements. 7.2 This DID is applicable to contracts which specify environmental stress screening. 7.3 This DID relates to DI-RELI-80250, Reliability Test Plan; and DI-RELI-80251, Reliability Test Procedures. 7.4 It is not intended that all requirements contained herein should be applied to every program phase. Portions of this DID are subject to deletion tailoring, dependent upon the program in which it is applied as specified in the contract. 7.5 This DID supersedes DI-ENVR-80172.				
8. APPROVAL LIMITATION		9a. APPLICABLE FORMS	9b. AMSC NUMBER	
			N3981	
10. PREPARATION INSTRUCTIONS 10.1 <u>Reference documents</u> . The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments and revisions, shall be as reflected in the contract. 10.2 <u>General</u> . The ESS report shall consist of three sections. The first section, "Random Vibration", and the second section, "Temperature Cycling", shall be included in the initial and each subsequent submittal of the report. The third section, "Laboratory Equipment Data", shall be included in the initial submittal of the report, and as indicated in 10.3.3. 10.3 <u>Content Requirements</u> . The ESS report shall consist of laboratory equipment identification and data recorded during random vibration and temperature cycling. It shall be formatted as described in the following paragraphs. 10.3.1 <u>Random Vibration</u> . The following random vibration data shall be reported in the initial and each subsequent submittal of the ESS report. Figure 1 may be used as a guide for reporting random vibration data. Any acronyms, symbols or codes used shall be fully defined. a. Report period (dates of the time period covered by ESS report). b. Equipment nomenclature (e.g. AN/URC-XXX). c. Equipment part number. d. Subassembly part number (if ESS is performed at the subassembly level). e. Date of the vibration screen. f. Serial number of the unit(s) subjected to vibration screen.				
11. DISTRIBUTION STATEMENT DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.				

## 10. PREPARATION INSTRUCTIONS (Cont'd)

- g. Axis of vibration.
- h. Time at the start of vibration.
- i. Time when vibration stopped.
- j. Duration of the vibration screen.
- k. Elapsed time from the start of vibration screen to each failure (if any).
- l. Failed component (circuit card, module or assembly).
- m. Part number or name of failed part.
- n. Reference designation of failed part.
- o. Failure mode of failed part.
- p. Cause of failure of part.
- q. Corrective action req'd, taken or planned.
- r. Analysis of results to determine screening effectiveness.
- s. Any recommended changes to the ESS procedures or program.

10.3.2 Temperature Cycling. The following temperature cycling data shall be reported in the initial and each subsequent submittal of the ESS report. Figure 2 may be used as a guide for reporting temperature cycling data. Any acronyms, symbols, or codes used shall be fully defined.

- a. Report period (date(s) of the time period covered by ESS report).
- b. Equipment nomenclature (e.g. AN/URC-XX).
- c. Equipment part number.
- d. Subassembly part number (if ESS is performed at the subassembly level).
- e. Date and time of temperature cycling (at the start of each cycle).
- f. Serial number of the unit(s) subjected to temperature cycling.
- g. Elapsed time from start of temperature cycling to each failure (if any).
- h. Number of the cycle during which each failure occurred.
- i. Indication of point in cycle when failure occurred (hot or cold).
- j. Failed component (circuit card, module or subassembly).
- k. Part number or name of failed part.
- l. Reference designation of failed part.

## 10. PREPARATION INSTRUCTIONS (Cont'd)

- m. Failure mode of failed part.
- n. Cause of failure of part.
- o. Corrective action req'd, taken or planned.
- p. Analysis of results to determine screening effectiveness.
- q. Any recommended changes to the ESS procedures or program.

10.3.3 Laboratory Equipment Data. The following data regarding laboratory equipment used to perform the environmental stress screen shall be included in the initial ESS report submittal. This data shall be included in a subsequent submittal only if any laboratory equipment is replaced prior to completion of the screening phase.

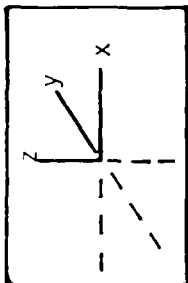
a. Random Vibration Equipment.

- (1) Identification by model number and manufacturer of equipment in the vibration system.
- (2) Photographs of mounting fixture and mounting arrangement for each item to be vibrated. The photographs must include enough detail to show mounting arrangements and accelerometer locations.
- (3) A plot of the actual random vibration spectrum recorded during vibration and used for control purposes, identifying frequencies, power spectral density, and degrees of freedom (or actual filter bandwidths used in the analyses of the spectrum).
- (4) Description of procedure used to perform the vibration.

b. Temperature Cycling Equipment.

- (1) Identification by model number and manufacturer of the temperature chamber.
- (2) Maximum and minimum temperatures.
- (3) Maximum and minimum rate of change of temperature.
- (4) Description of procedure used to perform the temperature cycling.

SUBASSY P/N



Z Axis-Top to Bottom

## AXES of VIBRATION

[illegible]

FIGURE 1. Random vibration data sheet (sample format)



## 10. PREPARATION INSTRUCTIONS (Cont'd)

## TEMPERATURE CYCLING

SHEET \_\_\_\_ of \_\_\_\_

PART NUMBER \_\_\_\_\_

Report Period \_\_\_\_\_

EQUIPMENT NOMENCLATURE \_\_\_\_\_

SUBASSY P/N \_\_\_\_\_

DATE OF TEMPERATURE CYCLING	EQUIP. SERIAL NUMBER (S/N)	TIME TO FAILURE	F A I L U R E S					Reference Designator	Failure Mode	Failure Cause	REMARKS
			CYCLE 1 - 10	TEMP Hot/Cold	Failed Comp/Mod	Failed Part Name or P/N					
ADDITIONAL COMMENTS:											

FIGURE 2. Temperature cycling data sheet (sample format)

## DI-RELI-80249/T

## ENVIRONMENTAL STRESS SCREENING (ESS) REPORT

## TAILORED REQUIREMENTS

The comments below are used to clarify the Data Item Description preparation instructions, paragraph 10.

- |                          |   |
|--------------------------|---|
| 10.2 and 10.3            | Change "Laboratory" to "Screening"  |
| 10.3.1.c and<br>10.3.2.c | Add "...and National Stock Number (NSN) if applicable."   |
| 10.3.1.g                 | Change to read: "Axis(es) of vibration."  |
| 10.3.1.k and<br>10.3.2.g | Add to end of sentence: "...when screened powered and functioning."   |
| 10.3.1.m and<br>10.3.2.k | Change to read: "Part number and name of failed part, include NSN if applicable. Include manufacturer's lot date code for failed electronic components (piece-parts)."  |
| 10.3.1.n and<br>10.3.2.l | Change to read: "Engineering drawing or technical order (specify) reference designation of failed part."  |
| 10.3.3                   | Change "Laboratory" to "Screening"  |
| 10.3.3                   | Change last sentence to read: "... replaced or if fixturing, mounting, or controlling arrangements change prior to completion of screening."  |
| 10.3.3.a.(2)             | Change first sentence to read: "Photographs, engineering drawings or sketches ..."  |
| 10.3.3.a.(3)             | Change to read: "A plot of the actual random vibration spectrum recorded during vibration and used for control purposes. The data will identify frequency range, power spectral density over the frequency range, and degrees of freedom (or actual filter bandwidths used in the analyses of the spectrum) for each axis of vibration. The data will show the relationship between the controller programming and/or the |

system input and the response at the article under screening."

10.3.3.b

Add new items (2) and (3) below. Renumber existing items (2) through (4) through (6).

(2) Photographs, engineering drawings or sketches of mounting fixtures and arrangement for each item to be thermal cycled if different from 10.3.3.a.(2) above. The data must show the controlling and monitoring thermocouple locations.

(3) A plot of the actual thermal profile recorded during thermal cycling and used for control purposes. The thermal profile will show the relationships between chamber controller programming and actual chamber air temperature and between chamber air temperature and temperatures at each assembly under screening. Data will show temperature changes as a function of time, maximum/minimum temperatures, maximum rates of change for heat-up/cool-down, and dwell times at temperature extremes.

# CONTRACTOR DATA REQUIREMENT SUBSTANTIATION

IDENTIFICATION													
CONTRACT/PR NUMBER		SYSTEM/ITEM											
DD FORM 1423 ENTRIES													
1. SEQUENCE NO.	2. TITLE OR DESCRIPTION OF DATA	3. SUBTITLE	4. AUTHORITY (Data Item Number)	5. CONTRACT REFERENCE	6. TECHNICAL OFFICE	7. DD 250 REG	8. AFPR CODE #	9. IN-TO IAC	10. FREQUENCY	11. AS OF DATE	12. DATE OF 1ST SUBMISSION	13. DATE OF SUBSEQUENT SUBMITTAL	14. DISTRIBUTION AND ADDRESSES (Addressee - Regular/extra copies)
	Stress Screening (ESS) Report				ASREQ					Item 16	Item 16		
<p>DI-RELI-80249/T</p> <p><b>REMARKS</b></p> <p>Blk (4) Requirements for ESS Report are specified in the attached tailored Data Item Description.</p> <p>Blk (11) (12) (13) Reports shall be submitted NLT 30 days prior to the shipment of the deliverable items as required in the SOW. The report may cover-block production or individual units depending on the delivery schedule.</p> <p>Item 10.3.3 "Screening Equipment" will be completed only once unless the contractor changes the screening regimen, technique, procedure or equipment.</p>													
<p><b>JUSTIFICATION/TAILORING/DISPOSITION</b></p> <p>17. JUSTIFICATION: STATE HOW THE DATA WILL BE USED, WHO WILL USE IT, AND THE IMPACT IF IT IS NOT OBTAINED.</p> <p>a. The data will be used to evaluate the effectiveness of the contractor's ESS program to eliminate manufacturing defects which degrade product performance from its design capability and through design changes improve product reliability.</p> <p>b. The data will be used by:            (1) Cognizant Engineer            (2) Reliability Engineer/MMEAR</p> <p>c. Without this data the results of the ESS program cannot be evaluated as effective for the equipment procured under this contract. An ineffective ESS program would result in the delivery of unreliable equipment or damaging good equipment.</p> <p>* Distribution Statement required in accordance with AFR 80-45</p>													
<p>18. CHECK APPLICABLE BOXES)</p> <p>CONTRACTOR FORMAT ACCEPTABLE</p> <p>DID REQUIREMENTS TAILORED</p> <p>DELIVERY CAN BE DEFERRED</p> <p>19. REQUESTER IDENTIFICATION</p> <p>NAME</p> <p>ORGANIZATION</p> <p>PHONE</p> <p>DATE</p> <p>20. DATA REQUIREMENTS REVIEW BOARD DISPOSITION</p> <p><input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED <input type="checkbox"/> OTHER</p> <p>REMARKS</p> <p>DATE</p> <p>SIGNATURE</p>													

15 June 88

APPENDIX D  
DIVISION STATUS REPORT

ESS STATUS REPORT FOR MM\_\_\_\_\_

---

REPORTING PERIOD

---

# OF ITEMS REVIEWED

\* ORGANIC

\* CONTRACT

---

# OF ESS APPLICABLE ITEMS

\* ORGANIC

\* CONTRACT

---

# OF ITEMS WITH  
ESS INCLUDED

\* ORGANIC

\* CONTRACT

---

# OF ENGINEERING PROJECTS  
FOR INCORPORATION OF ESS

\* ORGANIC

\* CONTRACT

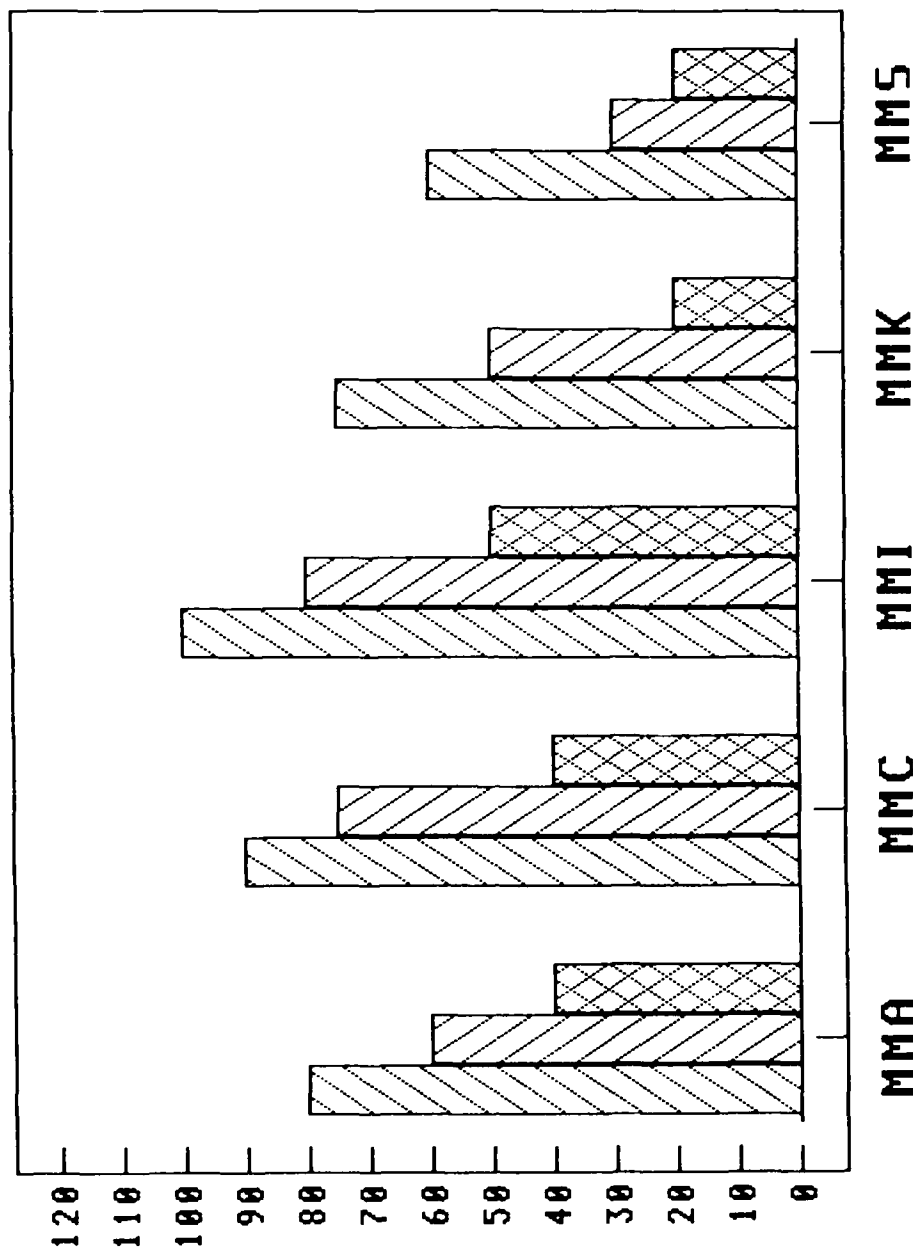
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15 June 88

APPENDIX E  
SM-ALC ESS STATUS REPORT

# ESS APPLICATIONS

DATE: JAN 88 TO JUN 88



## DIVISIONS

TOTAL ITEMS
 ESS APPLICABLE

ESS INCLUDED





15 June 88

APPENDIX F  
ESS CERTIFICATION FORM  
AND  
CERTIFICATION FLOWCHART

DATE \_\_\_\_\_

Environmental Stress Screening (ESS) Certification:

NSN \_\_\_\_\_ PR # \_\_\_\_\_  
NOUN \_\_\_\_\_ (Not required to complete Form)

NAME \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
Name of PR initiator Code Symbol Phone

1. This paragraph is completed by the PR initiator. Check any of the following statements that are applicable: ESS is not required because:

- \_\_\_\_\_ This buy/repair is less than \$ \_\_\_\_\_ (Highest dollar value).
- \_\_\_\_\_ The quantity of this buy/repair is less than 10.
- \_\_\_\_\_ This PR is for foreign military sales (FMS).
- \_\_\_\_\_ This PR is for an engineering services contract.
- \_\_\_\_\_ This item is commercial off-the-shelf, used in a benign environment.
- \_\_\_\_\_ This item contains no electronic components.
- \_\_\_\_\_ This item is a discrete component.
- \_\_\_\_\_ This PR is for a rebuy of an item presently in the inventory that has a high reliability.

\_\_\_\_\_ / \_\_\_\_\_  
Signature of PR Initiator Title

2. This item is not completed if any item in paragraph 1 is checked. If no items in paragraph 1 are checked, ESS may be required and this paragraph must be completed by an engineer.

- \_\_\_\_\_ ESS is called out by the data package and the ESS specifications and criteria are part of the data package.
- \_\_\_\_\_ This PR is for a design development and the ESS requirements will be developed as part of the contract.
- \_\_\_\_\_ The ESS specification is not part of the data package. Engineering will pursue developing the ESS specification to be included in future PRs. The engineering project number is: \_\_\_\_\_
- \_\_\_\_\_ ESS is not required in this PR because \_\_\_\_\_

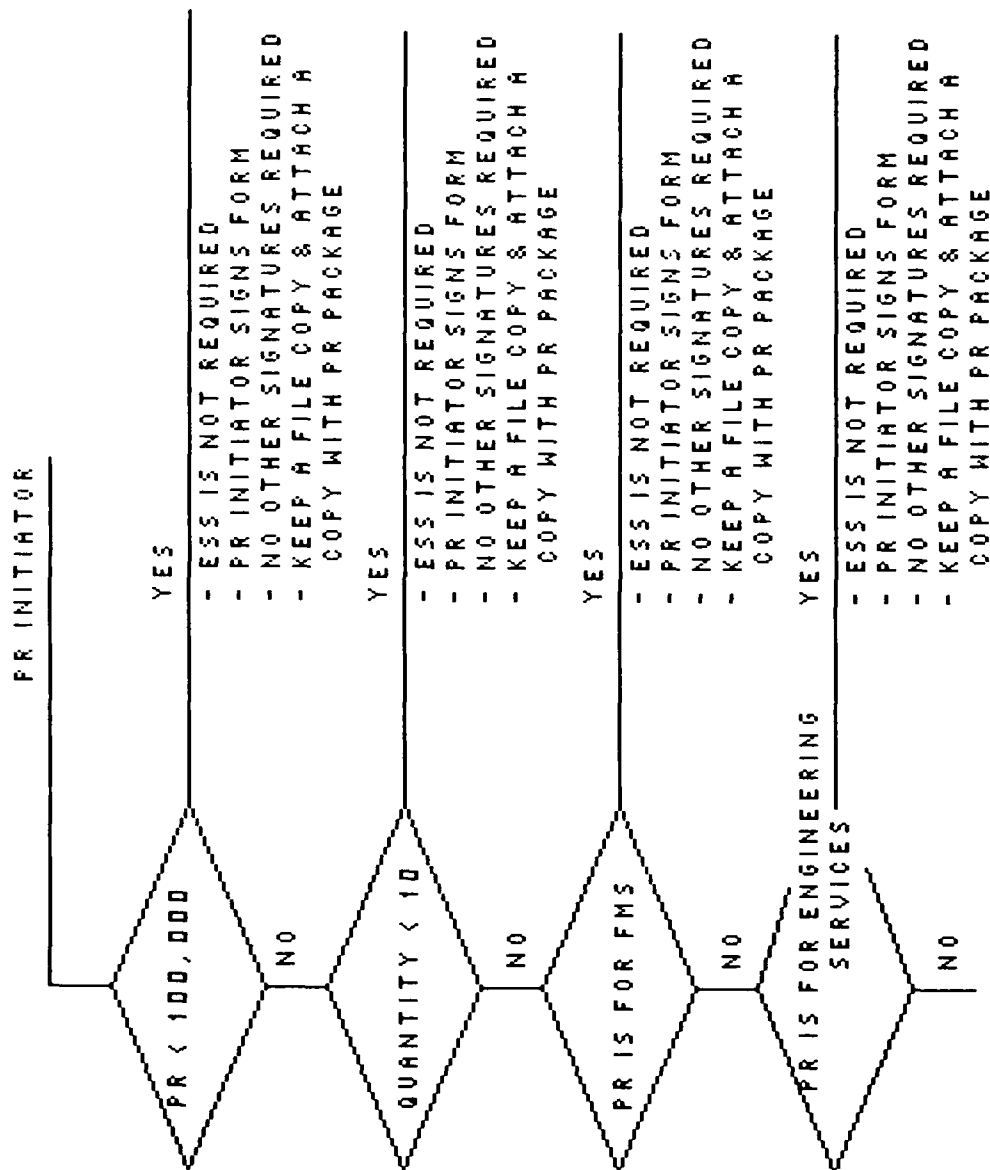
The following signatures are required only if paragraph 2 is completed:

Engineer \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
Name Symbol Phone

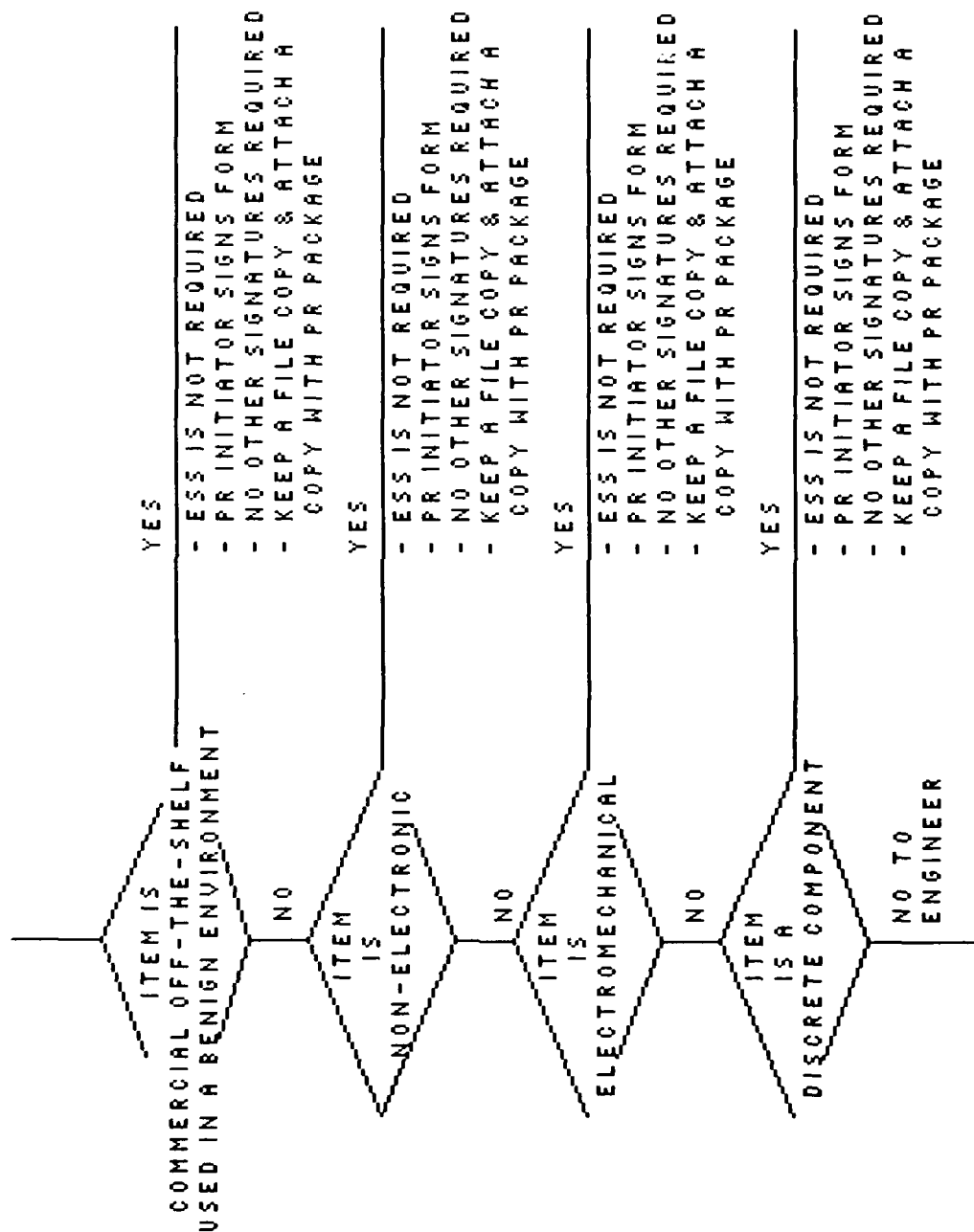
\_\_\_\_\_ / \_\_\_\_\_  
Signature of Engineer Title

\_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
Signature R&M Focal Point Symbol Title

# PR/MIPR ESS CERTIFICATION FLOW DIAGRAM

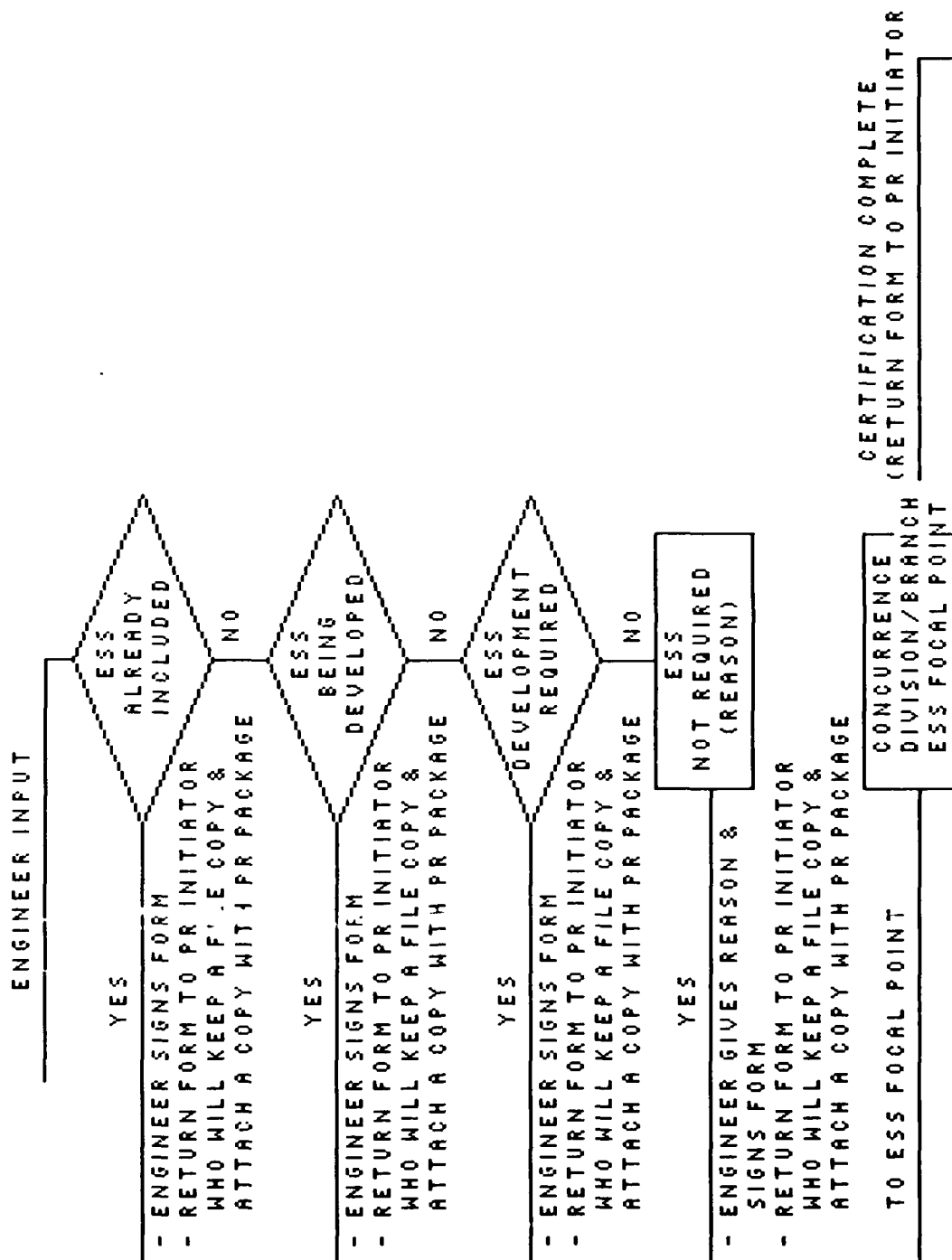


# PR/MIPR ESS CERTIFICATION FLOW DIAGRAM



SHEET 2 OF 3

# PR/MIPR ESS CERTIFICATION FLOW DIAGRAM



15 June 88

APPENDIX G  
SM-ALC ESS SELECTION MATRIX

**SACRAMENTO AIR LOGISTICS CENTER**  
**ESS SELECTION MATRIX**

EQUIPMENT CHARACTERISTIC	SCORE						
	DISQUAL	0	1	2	3	4	5
# OF UNITS REPAIRED/YEAR	<10	10-25	26-50	51-100	101-150	151-200	>200
AGE OF UNIT (AVERAGE)	-	>25	21-25	16-20	11-15	6-10	0-5
REMAINING LIFE YEARS (AVG)	<1	1-5	6-10	11-15	16-20	21-25	>25
MDRs/QDRs PER YEAR (TOTAL)	-	0-5	6-10	11-15	16-20	21-25	>25
MAINT SUPP COST PER YR (\$000)	<10	10-25	26-50	51-100	101-250	251-500	>500
CNDs PER UNIT PER YEAR	-	2	5	7	8	9	>10

4 NOV 87  
REVISED: 21 APR 88



15 June 88

APPENDIX H

SPECIFICATION AND STATEMENT OF WORK (SOW) PREPARATION GUIDELINES

23 FEB 1999

FROM: MMM

SUBJ: Application of Military Specifications and Standards as  
part of Reliability and Maintainability (R&M) 2000

TO: MMA MMC MME MMI MMK MMS MMT MMMC CRE DST MAB  
MAC MAD MAI MAN MAQ MAW PMK PMW PMZ SEE

1. Military specifications and standards are an integral part of our statements of work (SOW) and engineering specifications. As such they become part of the purchase request and resultant contract. In keeping with the quality portion of General Hansen's command goals of which R&M is a part, we must comply with the requirement to tailor and date the military specifications and standards we reference in our SOW and engineering specifications. Additionally, we have been advised by both HQ AFLC/MMM and SM-ALC/PMC that we are not complying with certain Federal Acquisition Regulation (FAR) requirements in applying specifications and standards in our statements of work. See attachments 1 and 2.

2. Application of military specifications and standards are contained in FAR 10.004 and 10.008. These paragraphs and the specific tailoring and dating requirements are contained in attachment 3.

3. Policies and procedures for the selective application and tailoring of specifications and standards are contained in DOD 4120.3M, chapter 7. AFLCR 800-6 is the implementing regulation and provides additional guidance. As discussed in paragraph 7-100 of DOD 4120.3M, unnecessary requirements do not contribute to mission performance, but impose additional cost. With our diminishing resources, we must concentrate on improving quality and reducing costs. One of the ways we can do this and meet the objectives of R&M 2000 is to insure our acquisition documents are tailored to reflect our minimum essential needs. Additionally, we must be sure our contracts are enforceable.

4. DOD 4120.3M, Section 4, paragraph 7-401, assigns the final responsibility for selecting, applying and tailoring specifications and standards to the program/project manager with individual responsibilities assigned to the configuration manager, project system engineer, and subsystem, equipment, or technology engineer. At this Air Logistics Center, program managers are considered to be anyone responsible for a defined effort. These individuals will ensure that selective tailoring is accomplished, but specialists or technicians in the

functional areas will tailor their respective specifications, standards and data item descriptions (DIDs) that apply to their areas of responsibility. They will also determine the approval dates of the applicable specifications and standards. When a data call is initiated, a draft SOW will be provided to each functional area for input. Responses to the data call will include tailoring references of specifications, standards, any other documents and approval dates, as well as the applicable DIDs, for each functional area. When the final SOW is written, these tailoring references will be included in an index. This index will identify to the contractor the extent to which the specifications and standards are tailored, and will also identify which DIDs are applicable. See attachment 4 for preparation of the index.

5. Military specifications, standards and other applicable documents will be tailored and SOWs will be written to reflect only minimum essential requirements. Data management officers will ensure that this is accomplished and will not accept the data call package for preparation of the consolidated DD Form 1423 unless it is. We must comply with these requirements to improve quality and reduce acquisition costs.

6. For additional information, contact Doreen Buck, MMTT, 3-4996.



DONALD L. CAZELL, II  
Deputy Chief, Resources Management Div  
Directorate of Materiel Management

4 Atch

1. HQ AFLC/MMM ltr,  
24 Apr 87
2. PMC ltr, 16 Dec 87
3. FAR paragraphs  
10.004 & 10.008
4. Index preparation

cc: PMC w/atc 4



REPLY TO  
ATTN OF MNNM

**SUBJECT** Contract Data Package Deficiencies

24 APR 1987

10 OO-ALC            SA-ALC            SM-ALC            WR-ALC

(Director of Materiel Management)

1. The Defense Contract Administration Services Region (DCASR), Boston has asked our support to help reduce AFLC contract data package deficiencies. The DCASR is specifically concerned about the consistent lack of revision dates and levels to contract specifications/standards.
2. Although no specific comments have been received concerning your activity, we are informed that we in AFLC are not consistently in compliance with FAR requirements. Therefore, we request your added emphasis for the FAR 10.008 requirements, particularly paragraphs 10.008(b) and (e). ~~See memo to [redacted] dated 10/1/83.~~
3. We should assure ourselves that our contracts are enforceable in the event we experience difficulties with our contractors. If specifications are not accurately cited then we will be hard-pressed to hold contractors responsible for deficient work. Please review training, procedures and policies for impact on this problem.
4. Our point of contact for this issue is Maj Bolles, MMMRP, AUTOVON 787-5337. Please advise him if you require additional information.

FOR THE COMMANDER

Barry & Oliver

BARRY L OLIVER  
Asst for Rqmts Policy  
DCS Materiel Management

cc: PM

ateh.



## DEPARTMENT OF THE AIR FORCE

HEADQUARTERS SACRAMENTO AIR LOGISTICS CENTER (AFLC)  
McCLELLAN AIR FORCE BASE, CALIFORNIA 95652-5320

16 DEC 1987


REPLY TO  
ATTN OF PMC

SUBJECT Dating of Specifications

TO MMMTT

1. During PMC solicitation and contractual reviews, it has been noted that the specifications listed in Statements of Work (SOW) are not being dated in accordance with FAR. FAR 10.008 states that specifications shall be identified by approval date and the dates of any applicable revisions. The FAR goes on to state that general identification references such as "the issue in effect on the date of the solicitation" shall not be used.

2. Please inform all personnel in the review process of the requirements of FAR 10.008.

  
ALLEN R. TAYLOR  
Chairman, Contracts Committee  
Directorate of Contracting & Mfg

UNITED STATES AIR FORCE



SEPTEMBER 18, 1947

atch 2

FAR 10.004 and 10.008, tailoring and dating requirements of applicable specifications and standards:

10.004(a)(3). Specifications and standards shall be selectively applied and tailored in their application.

10.004(a)(3)(i). "Selective application" is the process of reviewing and selecting from available specifications, standards, and related documents those which have application to a particular acquisition.

10.004(a)(3)(ii). "Tailoring" is the process by which individual sections, paragraphs or sentences of the selected specifications, standards and related documents are reviewed and modified so that each one selected states only the Government's minimum requirements.

10.008(a). Solicitations citing specifications listed in the Index of Federal Specifications and Standards, DODISS, or other agency index shall identify each specification's approval date and the dates of any applicable amendments and revisions.

10.008(b). Solicitations shall not contain general identification references such as "the issue in effect on the date of the solicitation."

10.008(e). When specifications refer to other specifications, such references shall (1) be restricted to documents, or appropriate portions of documents, that shall apply in the acquisition; (2) cite the extent of their applicability; (3) not conflict with other specifications and provisions of the solicitation; and (4) identify all applicable first tier references.

### Preparation instructions for tailoring index

1. To begin the tailoring process, a draft statement of work (SOW) must first be prepared and issued with the data call. The program manager will ensure a draft SOW is prepared. This must be accomplished far enough ahead of the procurement to allow time for tailoring and revising the SOW.

2. Recipients of the data call will review their portion of the SOW draft and revise it, if necessary, to reflect their particular requirements. They will tailor their applicable specifications, standards, any other applicable documents and their particular data item descriptions, when required. Depending on how the program manager wishes to proceed, there may be a working group meeting in which the program and support requirements are discussed. At the time of the data call, recipients will be advised when and where to return their input. Input will include the tailoring references for the individual who is designated to prepare the index.

3. After the working group meeting, data requirements review board (DRRB) or data management officer's review, the SOW will be finalized and a tailoring index prepared to accompany the SOW as follows:

a. In a column headed 'applicable documents', list the specifications, standards or other applicable documents in numeric sequence with the current date of each.

b. Next to each document number, list the paragraphs or sections that apply or do not apply, whichever is most convenient to do. If portions of the document apply to particular phases of the program, identify these also. Do this by listing each phase separately and listing the parts of the document that are applicable to it.

c. In a column headed 'applicable data item descriptions', list the applicable data item descriptions also in numerical sequence. If they are tailored, add '/T' to the number.

d. Next to the DID, list the paragraph in the SOW which specifies the task causing the data to be generated.

e. In the SOW, reference the DID in parenthesis following the paragraph describing the task which generates the data.